

1. A light delivery catheter for inserting into a hollow body organ having target tissue and exposing the target tissue to light, the catheter comprising:

a. an elongated tubular catheter shaft having a proximal end which remains outside of the body organ when in use and a distal end which is inserted into the body organ when in use, the distal end having a light treatment zone through which light can be transmitted;

b. a light guide in the catheter shaft for transmitting light from a light source at the proximal end of the catheter shaft to the light treatment zone;

c. an occlusion balloon positioned on the distal end of the catheter shaft adjacent to the light treatment zone;

d. an inflation lumen in the catheter shaft and in fluid communication with the balloon for delivering fluid from an inflation fluid source at the proximal end of the catheter shaft to the balloon;

e. an infusion lumen in the catheter shaft for delivering infusion fluid from an infusion fluid source at the proximal end of the catheter shaft to the light treatment zone; and

f. a plurality of infusion ports formed on the light treatment zone and in fluid communication with the infusion lumen for delivering infusion fluid to the hollow body organ.

2. The catheter of claim 1, wherein the plurality of infusion ports are radially distributed around the circumference of the catheter shaft at the light treatment zone.
3. The catheter of claim 2, wherein the plurality of infusion ports comprises two  
5 infusion ports positioned around the circumference of the catheter shaft at about 180 degrees of radial separation, such that the pressure of infusion fluid passing through the ports is generally equalized.
4. The catheter of claim 2, wherein the plurality of infusion ports comprises at least  
10 three infusion ports positioned around the circumference of the catheter shaft at intervals of about 120 degrees or less of substantially uniform radial separation, such that the pressure of infusion fluid passing through the ports is generally equalized.
5. The catheter of claim 1, wherein the plurality of infusion ports are longitudinally distributed along the length of the light treatment zone.
- 15 6. The catheter of claim 1, wherein the optical guide is an optical fiber, the catheter further comprising a fiber lumen in the catheter shaft in which the optical fiber can be inserted and advanced to the light treatment zone.
7. The catheter of claim 1, wherein the optical guide is an optical fiber having a distal end terminating in a diffuser within the light treatment zone.
- 20 8. The catheter of claim 7, wherein the optical fiber is inserted within the inflation lumen.

9. The catheter of claim 7, further comprising a second optical fiber in the catheter shaft for detecting light emitted by the first optical fiber and transmitting the detected light to the proximal end of the catheter shaft, the second optical fiber having a distal end terminating in a diffuser-tipped fiber for light collection within the light treatment zone.
10. The catheter of claim 1, wherein the catheter shaft is transparent at the light treatment zone.
11. The catheter of claim 1, wherein the catheter shaft is translucent at the light treatment zone.
12. The catheter of claim 1, wherein the catheter shaft contains a scattering media at the light treatment zone.
13. The catheter of claim 1, further comprising a guidewire lumen extending through the catheter shaft.
14. The catheter of claim 13, further comprising an optical fiber in the catheter shaft for delivering light to the target tissue, the optical fiber having a distal end terminating in a diffuser within the light treatment zone, wherein the optical fiber is disposed within the guidewire lumen.
15. The catheter of claim 13, further comprising a rapid exchange guidewire port formed in the guidewire lumen and catheter shaft at the distal end of the catheter shaft.

16. The catheter of claim 15, wherein the rapid exchange guidewire port is positioned adjacent and proximal to the balloon.
17. The catheter of claim 15, wherein the rapid exchange guidewire port is positioned distal to the light treatment zone.
- 5 18. The catheter of claim 1, further comprising a centering balloon through which light can be transmitted, the centering balloon positioned over the light treatment zone.
19. The catheter of claim 18, wherein the inflation lumen is in fluid communication with the centering balloon and delivers fluid for inflating the centering balloon.
- 10 20. The catheter of claim 1, further comprising an angioplasty balloon through which light can be transmitted, the angioplasty balloon positioned over the light treatment zone.
21. The catheter of claim 1, wherein the balloon is distal to the light treatment zone.
22. The catheter of claim 1, wherein the balloon is proximal to the light treatment zone.
- 15 23. The catheter of claim 22, further comprising:
- a. a guidewire lumen extending through the catheter shaft; and
  - b. a perfusion port formed in the guidewire lumen and catheter shaft proximal to the balloon to provide a bypass channel for allowing fluid in

the hollow body organ to pass through the guidewire channel to the distal end of the catheter shaft when the balloon is inflated.

24. The catheter of claim 1, wherein the catheter shaft further comprises a narrowing transition adjacent to the light treatment zone, the narrowing transition reducing the diameter of the catheter shaft along the light treatment zone.

25. The catheter of claim 24, wherein the infusion lumen has a constricted portion along the light treatment zone.

26. The catheter of claim 24, wherein the infusion lumen terminates at an infusion port formed along the transition of the catheter shaft.

27. A light delivery catheter for inserting into a blood vessel having a vascular wall and exposing the vascular wall to light, the catheter comprising:

a. an elongated tubular catheter shaft having a proximal end which remains outside of the blood vessel when in use and a distal end which is inserted into the blood vessel when in use, the distal end having a light treatment zone through which light can be transmitted;

b. an optical fiber in the catheter shaft for delivering light from a light source at the proximal end of the catheter shaft to the light treatment zone, the optical fiber having a distal end terminating in a diffuser within the light treatment zone;

- c. an occlusion balloon positioned on the distal end of the catheter shaft proximal to the light treatment zone;
- d. an inflation lumen in the catheter shaft and in fluid communication with the occlusion balloon for delivering fluid from an inflation fluid source at the proximal end of the catheter shaft to inflate the balloon;
- e. an infusion lumen in the catheter shaft for delivering infusion fluid from an infusion fluid source at the proximal end of the catheter shaft to the blood vessel; and
- f. a plurality of infusion ports formed in the catheter shaft and infusion lumen through which infusion fluid can be delivered into the blood vessel, wherein the plurality of infusion ports are radially distributed about the circumference of the light treatment zone and longitudinally distributed along the length of the light treatment zone.

28. A light delivery catheter for inserting into a hollow body organ having target tissue and exposing the target tissue to light, the catheter comprising:

- a. an elongated tubular catheter shaft having a proximal end which remains outside of the body organ when in use and a distal end which is inserted into the body organ when in use, the distal end having a light treatment zone through which light can be transmitted;
- b. a light delivery optical fiber in the catheter shaft for delivering light from a light source at the proximal end of the catheter shaft to the light treatment

zone, the optical fiber having a distal end terminating in the light treatment zone; and

- c. a light detection optical fiber in the catheter shaft for detecting light emitted by the light delivery optical fiber and transmitting the detected light to the proximal end of the catheter shaft, the light detection optical fiber having a distal end terminating in the light treatment zone.

29. The catheter of claim 28, wherein the light delivery optical fiber comprises a diffuser tip at the distal end.

30. The catheter of claim 28, wherein the light detection optical fiber comprises a diffuser tip at the distal end.

31. The catheter of claim 28, further comprising a fluorescent material incorporated into the distal end of the catheter shaft to provide a fluorescent emission when exposed to light emitted from the light delivery optical fiber, whereby the fluorescent emission can be transmitted to the proximal end of the light detection optical fiber to monitor light delivery.

32. The catheter of claim 31, wherein the light detection optical fiber has a proximal end which remains outside of the body organ when the catheter is in use and wherein the fluorescent emission has an associated fluorescent wavelength, the catheter further comprising a wavelength selective optical element at the proximal end of the light detection optical fiber to separate the fluorescent emission.

33. The catheter of claim 32, wherein the wavelength selective optical element is a narrowband filter that passes the fluorescent wavelength and rejects extraneous wavelengths.
34. A light delivery catheter for inserting into a hollow body organ having target tissue and exposing the target tissue to light, the catheter comprising:
- a. an elongated tubular catheter shaft having a proximal end which remains outside of the body organ when in use and a distal end which is inserted into the body organ when in use, the distal end having a light treatment zone through which light can be transmitted;
  - b. an optical fiber in the catheter shaft for delivering light from a light source at the proximal end of the catheter shaft to the light treatment zone, the optical fiber having a distal end terminating the light treatment zone; and
  - c. a fluorescent material incorporated into the distal end of the catheter shaft to provide a fluorescent emission when exposed to light emitted from the optical fiber, whereby the fluorescent emission can propagate back to the proximal end of the optical fiber to allow monitoring of light delivery.
35. The catheter of claim 33, wherein the optical fiber has a proximal end which remains outside of the body organ when the catheter is in use and wherein the fluorescent emission has an associated fluorescent wavelength, the catheter further comprising a wavelength selective optical element at the proximal end of the light detection optical fiber to separate the fluorescent wavelength.



36. The catheter of claim 34, wherein the light detection optical element is a dichroic beam splitter.

37. A light delivery catheter for inserting into a hollow body organ having target tissue and exposing the target tissue to light, the catheter comprising:

- 5           a. an elongated tubular catheter shaft having a proximal end which remains outside of the body organ when in use and a distal end which is inserted into the body organ when in use, the distal end having a light treatment zone through which light can be transmitted, the catheter shaft having a variable diameter which forms a narrowing transition portion adjacent to  
10           the light treatment zone, the transition portion reducing the diameter of the catheter shaft along the light treatment zone;
- b. a light guide in the catheter shaft for transmitting light from a light source at the proximal end of the catheter shaft to the light treatment zone;
- c. an infusion lumen in the catheter shaft for delivering infusion fluid from  
15           an infusion fluid source at the proximal end of the catheter shaft to the hollow body organ, the infusion lumen having a variable diameter, wherein the diameter of the infusion lumen decreases at the transition portion of the catheter shaft; and
- d. one or more infusion ports formed in the catheter shaft and in fluid  
20           communication with the infusion lumen through which infusion fluid can be delivered into the hollow body organ.

38. A light delivery catheter for inserting into a hollow body organ having target tissue and exposing the target tissue to light, the catheter comprising:

- 5           a. an elongated tubular catheter shaft having a proximal end which remains outside of the body organ when in use and a distal end which is inserted into the body organ when in use, the distal end having a light treatment zone through which light can be transmitted, the catheter shaft having a variable diameter which forms a narrowing transition portion adjacent to the light treatment zone, the transition portion reducing the diameter of the catheter shaft along the light treatment zone;
- 10          b. a light guide in the catheter shaft for transmitting light from a light source at the proximal end of the catheter shaft to the light treatment zone;
- c. an infusion lumen in the catheter shaft for delivering infusion fluid from an infusion fluid source at the proximal end of the catheter shaft to the hollow body organ, the infusion lumen terminating at the transition portion of the catheter shaft; and
- 15           d. one or more infusion ports formed on or near the transition portion of the catheter shaft and in fluid communication with the infusion lumen through which infusion fluid can be delivered into the hollow body organ.

20          39. The light delivery catheter of claim 38, wherein the infusion lumen terminates in an infusion port located on the transition portion of the catheter shaft.